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HYBRID NYMPHAEAS

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During the last four years the collection of nymphaeas at the Garden has been greatly augmented and the area for carrying on experiments considerably increased. This has offered the writer greater opportunities for intercrossing and also for growing a larger number of fully developed plants during the summer months. Up to the present time it has been impossible to determine the law of heredity in the results obtained, but some interesting factors have appeared in the hybrids of *Nymphaea flavo-virens* Lehm., a species of Mexico, and *Nymphaea capensis* var. *zanzibariensis* (Casp.) Conard, native of Africa.

In 1912 *N. flavo-virens* ♀ was crossed with the blue-flowered form of *N. capensis* var. *zanzibariensis* ♂, and also with the light pink form, namely, *N. capensis* var. *zanzibariensis* f. *rosea* ♂. The hybrids from both crosses have been in the trade for several years, the former known as *Nymphaea* "William Stone" and the latter as "Mrs. C. W. Ward." Both are given as sterile by Dr. H. S. Conard in his 'Monograph of the Genus Nymphaea,' but those raised at the Garden produced at least 25 per cent of fertile seed, this factor allowing the work to be carried further.

Both varieties were subsequently self-pollinated. "Mrs. C. W. Ward," in the second generation, produced light pink, dark pink, and blue flowers, the light pink being identical with

Nymphaea "Stella Gurney." This undoubtedly proves the parentage of the original "Stella Gurney," which, according to Mr. James Gurney, was a spontaneous seedling through insect agency. The seeds of the Brachyceras group are carried over the winter in the ponds outside, and readily germinate the next season during May, while those of *Euryale ferox* germinate even if the ponds have been drained. *Nymphaea* "William Stone" produced the same breaking up into blues and pinks as "Mrs. C. W. Ward," and there was no indication florally of the pistillate parent, *N. flavo-virens,* in either cross, but it was evident in the tubers and in the extremely long petioles.

Reciprocal crosses were also made between (FV ♀ × Z ♂) ♀ × (FV ♀ × Z rosea ♂) ♂ and (FV ♀ × Z rosea ♂) ♀ × (FV ♀ × Z ♂) ♂.[1] The only result attained was the intensifying of the color of the flowers, whereas the same gradation of the blues and pinks appeared. A final cross ([FV ♀ × Z ♂] ♀ × [FV ♀ × Z rosea ♂]) ♀ × ([FV ♀ × Z rosea ♂] ♀ × [FV ♀ × Z ♂]) ♂ produced a great variation from light pink to violet. The violet variety having the small floral character was nearest to the parent, *N. flavo-virens,* to date. As this factor was unusual, the flowers were carefully emasculated and self-pollinated. During 1915 ten plants were raised and finally planted out in 1916 for the summer development. The result was six plants of *N. capensis* var. *zanzibariensis,* the blue-flowered form, and four of *N. capensis* var. *zanzibariensis* f. *rosea,* the original pink form. There was no indication in either tuber or flowers of *N. flavo-virens.* The appearance of *zanzibariensis* types is interesting, especially as the type material had not been in the collection for two seasons.

The impossibility of suggesting the law of heredity can readily be seen when some characters are entirely absent and others are intensified in the offspring. Another factor to bear in mind is that nymphaeas contain several hundred seeds in one carpel, while one ovary may contain twenty to forty carpels, thus aggregating thousands of seeds in one pod. To

[1] FV = *N. flavo-virens;* Z = *N. capensis* var. *zanzibariensis;* Z rosea = *N. capensis* var. *zanzibariensis* f. *rosea.*

raise all plants required in working out the Mendelian law would necessitate a larger water area than the total area of the Garden.

× NYMPHAEA CASTALIIFLORA PRING, N. HYB.

(Nymphaea capensis var. *zanzibariensis* ♀ × *Nymphaea capensis* var. *zanzibariensis* ♂*).*

This pink-flowered hybrid is the result of intercrossing two light pink races of *N. capensis* var. *zanzibariensis* during 1912, the progeny being a great improvement over any previous hybrid. It was self-pollinated, with the object of fixing the

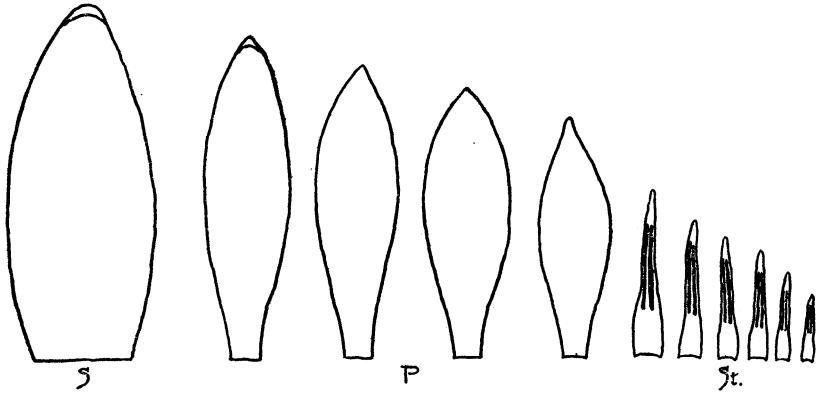

Fig. 1. *Nymphaea castaliiflora: S,* sepal; *P,* petals; *St,* stamens. One-half natural size.

light pink color, and during the first year one hundred plants were cultivated. The results showed 2 per cent of blue flowers, which, however, were inferior to the pink both in the size and number of the floral segments. The remaining 98 per cent were of the same dominant light pink color, with no variation, unlike *Nymphaea* "William Stone" and *Nymphaea* "Mrs. C. W. Ward."

The second year of self-pollination revealed flowers with a total exclusion of the blue color, the same dominant pink color being present, and the third year's experiments produced the same results. Therefore, the evidence suggests that this large, semi-double hybrid has become fixed. Homoeosis is well represented in the flower which bears four complete

whorls of petals, while other members of the Brachyceras group usually have but three. The arrest of the outer row of stamens is evidenced occasionally by a slight malformation of one or two petals, with indications of the bilocular anthers at the apex. The flower suggests the subgenus *Castalia* by its subconical buds and the open petals which rest on the surface of the water during the third and fourth day.

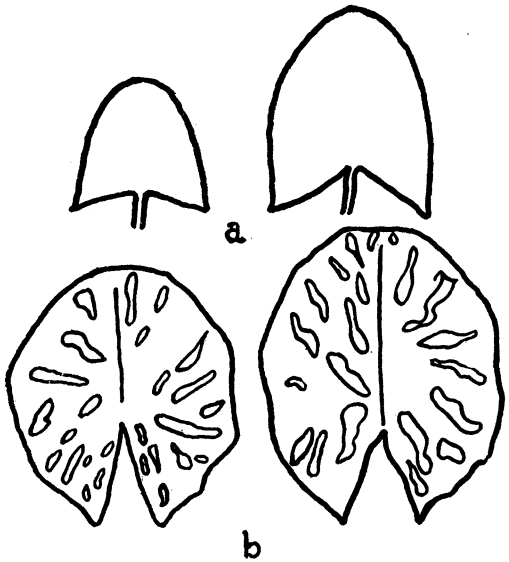

Fig. 2. *Nymphaea castaliiflora: a*, submerged leaves of seedling; *b*, first floating leaves. Natural size.

Description.— Flowers 8–10 inches across, opening 5–6 successive days from 7 A. M. to 6:30 P. M. during August, 4–6 open at one time, extremely fragrant; bud ovate to ovate-conical, light green; peduncle rising 7 inches above water, in cross-section showing 6 main air-canals surrounded by 12, these again by 24 smaller ones; receptacles yellow; sepals 4-wedged, ovate, $3\frac{1}{8}$ inches long, $1\frac{1}{2}$ inches wide, prominently hooded at the apex, thick, fleshy in texture, outer surface light green with pink margins, inner surface light pink, light green at the base, showing 10–15 nerves; petals 45–60; outermost whorl lanceolate, obtuse, slightly hooded at the apex, $3\frac{1}{2}$ inches long, $\frac{7}{8}$–1 inch wide, with the outer surface light pink channeled longitudinally with green, thickish in texture except along the margins, 7–8-nerved, and the inner surface light pink; the inner whorls pink, slightly acute, becoming shorter, narrower, and subacuminate towards the center; stamens 300–325; outermost whorl $1\frac{3}{4}$ inches long, with appendages ovate-oblong at the base, yellow, pink at the apex; the inner whorls

shorter and narrower toward the innermost, which is linear and white at the apex; carpels 45–50, with styles oblong, obtuse, introrse, yellow; fruit globose, containing numerous fertile seeds if pollinated through insect agency, not producing many when artificially pollinated; leaves of submerged seedling light green, broadly triangular, with acute lobes; first floating leaves orbicular with undulated margins, green prominently blotched with reddish brown on the upper surface, dark pink to pinkish red beneath; developed leaves orbicular, 1 foot 3 inches across, peltate, obtusely sinuate-dentate, green sparsely spotted with light brown on the upper surface, reddish pink beneath; sinuses overlapping; petioles brown, often attaining a length of 6 feet when fully developed.

× NYMPHAEA "MRS. EDWARDS WHITAKER" PRING, N. HYB.

(Nymphaea ovalifolia ♀ × *Nymphaea castaliiflora* Pring ♂.)

The recent introduction of seeds of *Nymphaea ovalifolia* Conard from Africa by the Bureau of Plant Introduction, of Washington, D. C., and their successful germination by Mr. E. T. Harvey, of Cincinnati, has placed the much-needed material before the hybridist.

Seeds of *N. ovalifolia* were sent from the Harvey collection and raised at the Garden during 1915. This species is a strong-growing type, producing large white flowers, but with one defective feature—the small number of petals. A large number of the plants raised produced both blue and pink at the tips of the petals. To counterbalance this defect in the perianth this species was crossed with the semi-double *N. castaliiflora,* the latter being used as the pollen parent. The fertilization was accomplished at the first trial, *N. ovalifolia* being very receptive to artificial pollination. The reciprocal cross was made repeatedly with no results. The seeds of the hybrid, *N. ovalifolia* ♀ × *N. castaliiflora* ♂, germinated readily, and during the summer months produced the largest flowers of any of the Brachyceras types. The color of the flowers varied from lavender-blue to dark blue. This color was retained for the first few days, then an unusual factor appeared —the blue color bleaching to almost white and the lavender-

blue to pure white. The dominance of the blue color is contrary to the results with the *N. flavo-virens* ♀ ×*N. capensis* var. *zanzibariensis* f. *rosea* ♂ cross, no doubt being derived from *N. ovalifolia,* as the pink *N. castaliiflora* is apparently fixed. It suggests that *N. ovalifolia* is derived from a blue parent.

There are two separate leaf characters which warrant a segregation: (1) a distinct marmoration on the upper sur-

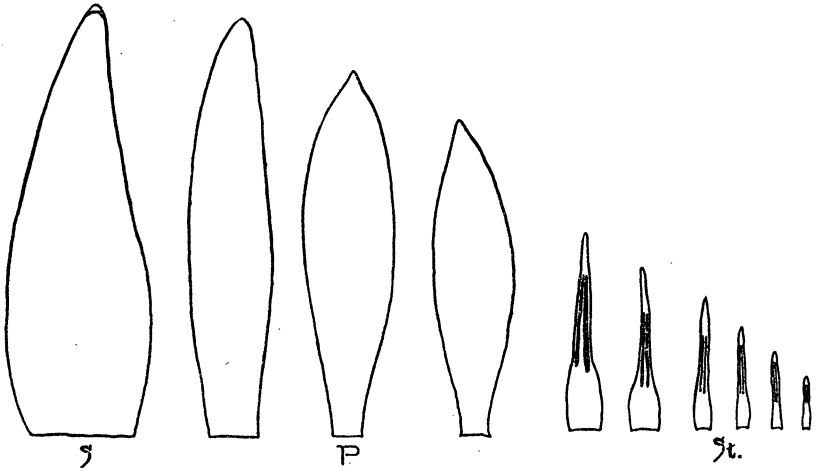

Fig. 3. *Nymphaea* "Mrs. Edwards Whitaker": *S,* sepal; *P,* petals; *St,* stamens. One-half natural size.

face of the leaves, which is obtained from both parents, plainly evident in the seedling leaves only of *N. castaliiflora* and in both seedling and developed leaves of *N. ovalifolia;* (2) the dark green color of the upper surface and the light green densely spotted with purplish blue on the under side, this being the dominant leaf character. The former is characterized below as a horticultural variety *marmorata.*

Some parental characters are plainly evident, and others are exaggerated; as, for instance, the number of petals and stamens are intermediate, showing an increase over the pistillate parent and a decrease from that of the staminate side. The outer petals are hooded and show the influence of *N. castaliiflora,* and an improvement over either parent is evident in the size of the flower. The prominent markings on

the sepals show a decided increase over *N. ovalifolia,* whereas in *N. castaliiflora* they are entirely absent. The seed pods contain a very low percentage of fertile seed compared with either parent. The main air-canals in the peduncle suggest *N. ovalifolia.* The leaves are fairly intermediate, suborbicular, with deeply sinuate margins, and the under side shows an increase of maculations over *N. ovalifolia,* from which parent they are transfused. The red color on the under side of the seedling leaves suggests *N. castaliiflora,* this factor, however, being lost in the developed leaves of the type plant. The leaves of the variety *marmorata* show a reddish pink color, with the marmorations intensified in the upper surface. This intensifying of some factors which are only transfused from a single parent is interesting. Previously described hybrids which contain *N. caerulea,* the Egyptian blue lily, show the same peculiarity.

Description.—Flowers 10–11 inches across, opening from 5 to 6 successive days from 6:30 A. M. to 7 P. M. during August, 4–8 open at one time, extremely fragrant; bud narrowly ovate-acuminate, dark green prominently striped with dark purple; peduncle rising 1 foot above the water, in cross-section showing 7–8 main air-canals circled by 14–16 smaller ones, these again irregularly surrounded by still smaller air-canals; sepals 4-wedged, ovate, 4¾ inches long, 1½ inches wide, slightly hooded at the apex, thick, fleshy in texture, outer surface dark green prominently striped with dark purple, lavender-blue on the margins, inner surface lavender-blue, light green at the base, showing 10–15 nerves; petals 30–35, comprising three whorls; the outermost lanceolate, obtuse, 4½ inches long, 1 inch wide, with the outer surface lavender-blue bleaching to white, channeled with green and striped with purplish lines, thickish in texture except along the margins, 6–8-nerved, and the inner surface lavender-blue bleaching to white; the inner whorls lanceolate, acute, becoming shorter toward the center, lavender-blue bleaching to white; stamens 170–180; outermost whorl 2⅛ inches long, with appendages ovate-oblong at the base, yellow, linear above, lavender-blue at the apex; inner whorls becoming shorter and narrower toward

the innermost, which is linear and white at the apex; carpels 30–35, with styles oblong, obtuse, introrse, yellow; fruit globose, containing a low percentage of fertile seeds; leaves of submerged seedling light green, linear-ovate to deltoid, with

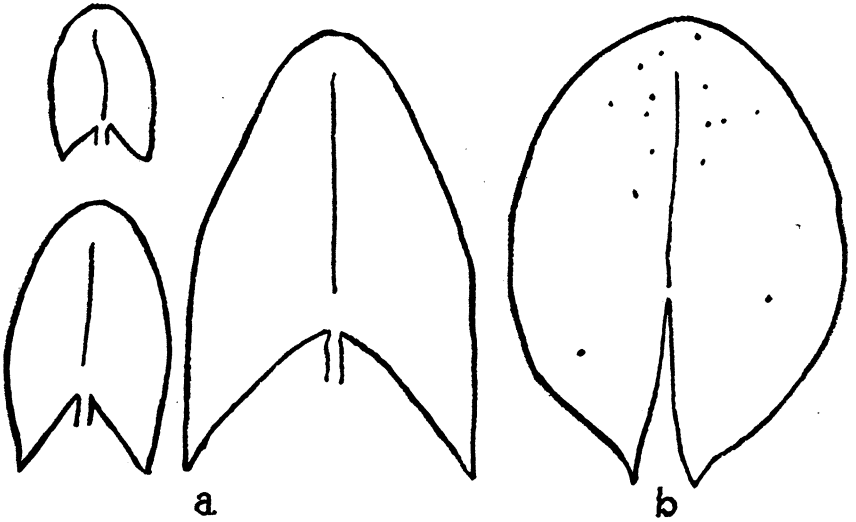

Fig. 4. *Nymphaea* "Mrs. Edwards Whitaker": *a*, submerged leaves of seedling; *b*, first floating leaf. Natural size.

acute lobes; first floating leaves ovate, light green occasionally spotted with dark green on the upper surface, dark red densely spotted with purplish blue on the under side; developed leaves narrowly peltate, suborbicular, 1 foot 3 inches across with deeply sinuate margins, almost entire at the apex; sinuses overlapping, terminating into ovate, acuminate lobes, dark green on the upper surface, rarely spotted with brownish green at the base, the under surface light green densely spotted with purplish blue spots, becoming smaller towards the margin; petioles dark green, often measuring 8–10 feet when fully developed.

× NYMPHAEA "MRS. EDWARDS WHITAKER" HORT. VAR. MARMORATA PRING, N. VAR.

Description.—Flowers same as in the type; leaves of submerged seedling light green spotted with dark green on the upper surface, linear-ovate to deltoid, lobes acute; first float-

ing leaves ovate, light green irregularly blotched with reddish brown on the upper surface, dark red densely spotted with purplish blue on the under side; developed leaves narrowly peltate, suborbicular, with deeply sinuate margins, almost

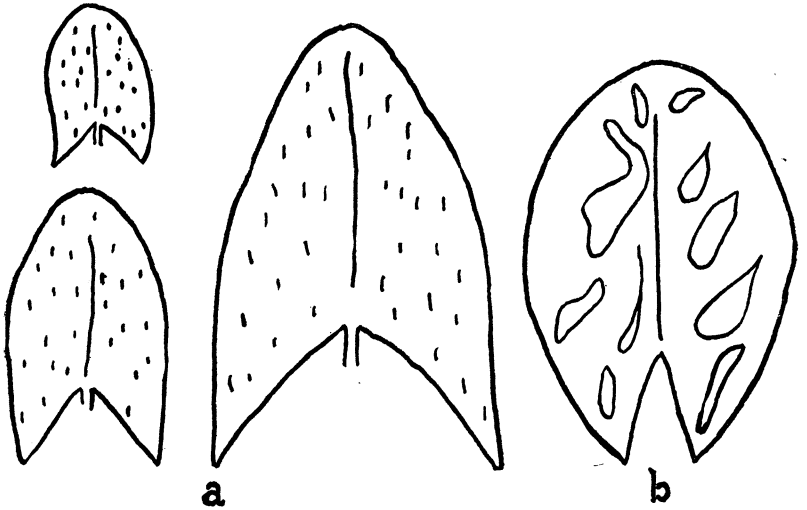

Fig. 5. *Nymphaea* "Mrs. Edwards Whitaker" hort. var. *marmorata: a*, submerged leaves of seedling; *b*, first floating leaf. Natural size.

entire at the apex; sinuses overlapping, terminating into ovate-acuminate lobes, prominently blotched with dark red on the upper surface, slightly fading on the old leaves, light green shaded with pink and spotted with purplish blue on the under side.

Explanation of Plate

PLATE 1

Nymphaea "Mrs. Edwards Whitaker" Pring, n. hyb. One-third natural size.

NYMPHAEA "MRS. EDWARDS WHITAKER" PRING

COCKAYNE, BOSTON

EXPLANATION OF PLATE

PLATE 2

Leaf of *Nymphaea* "Mrs. Edwards Whitaker" hort. var. *marmorata* Pring, n. var. One-third natural size.

LEAF OF NYMPHAEA "MRS. EDWARDS WHITAKER" VAR. MARMORATA PRING

COCKAYNE, BOSTON

EXPLANATION OF PLATE

PLATE 3

Nymphaea castaliiflora Pring, n. hyb. One-third natural size.

NYMPHAEA CASTALIIFLORA PRING

COCKAYNE, BOSTON